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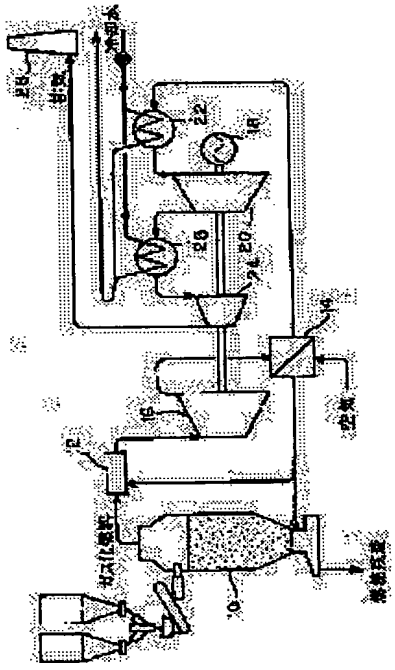
(54) ATMOSPHERIC PRESSURE GASIFICATION GENERATING DEVICE AND EMISSION CIRCULATION TYPE ATMOSPHERIC PRESSURE GENERATING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To develop a technique suitable for recovering energy from atmospheric pressure and high temperature gas.
SOLUTION: In a turbine generating device, a combustor 12 is arranged at a front stage of a turbine 16 of a turbo machine, wherein the turbine 16 and compressors 20, 24 are connected with a shaft. Working fluid sequentially passes through the combustor 12, the turbine 16, and the compressors 20, 24 so as to generate axial output for generating power. This device comprises a gasification furnace 10 for gasification combusting various fuels, biomass and/or wastes; a regeneration heat exchanger 14 for heat-exchanging and cooling high temperature working gas from the turbine 16 with outside air, and preheating the outside air; and coolers 22, 26 for heat-exchanging the working gas with cooling medium at the inlet and intermediate of the compressors 20, 24 and cooling the gas. Combustible gas generated in the gasification furnace 10 is introduced to the combustor 12 as fuel, and the preheated air from the regeneration heat exchanger 14 is introduced to the combustor 12 and the gasification furnace 10.



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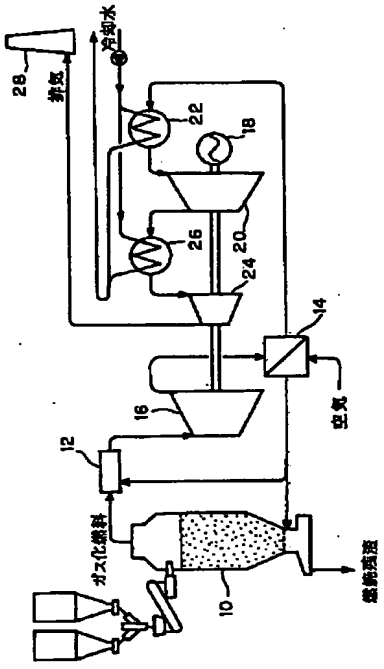
(54)【発明の名称】　常圧ガス化発電装置及び排気循環型常圧発電装置

(57)【要約】
【課題】　常圧・高温ガスからのエネルギ回収に適した技術を開発する。
【解決手段】　タービン１６と圧縮機２０、２４が軸で結ばれているターボ機械のタービン１６前段に燃焼器１２を配し、その作動流体が燃焼器１２、タービン１６、圧縮機２０、２４の順序で通過することで軸出力を生じさせて発電を行うタービン発電装置において、各種燃料、バイオマス又は／及び廃棄物をガス化燃焼させるガス化炉１０と、タービン１６を出た高温作動ガスを外気と熱交換して冷却するとともに外気を予熱する再生熱交換器１４と、圧縮機２０、２４の入口及び中間で作動ガスを冷却媒体と熱交換して冷却する冷却器２２、２６とを備え、ガス化炉１０で生成した可燃ガスを燃料として燃焼器１２に導入するとともに、再生熱交換器１４からの予熱空気を燃焼器１２及びガス化炉１０に導入する。



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【特許請求の範囲】

【請求項１】　タービンと圧縮機で構成されているターボ機械のタービン前段に燃焼器を配し、その作動流体が燃焼器、タービン、圧縮機の順序で通過することで軸出力を生じさせて発電を行うタービン発電装置において、各種燃料、バイオマス又は／及び廃棄物をガス化燃焼させるガス化炉と、タービンを出た高温作動ガスを外気と熱交換して冷却するとともに外気を予熱する再生熱交換器と、圧縮機の入口及び中間で作動ガスを冷却媒体と熱交換して冷却する冷却器とを備え、ガス化炉で生成した可燃ガスを燃料として燃焼器に導入するとともに、再生熱交換器からの予熱空気を燃焼器及びガス化炉に導入するようにしたことを特徴とする常圧ガス化発電装置。

【請求項２】　再生熱交換器を直列に２つ設けて、タービンを出た高温作動ガスを高温再生熱交換器、低温再生熱交換器の順で通過させて冷却し、高温再生熱交換器にてタービン出口の高温作動ガスを圧縮機からの排気ガスの一部及び低温再生熱交換器で排気ガスと同温度レベルに予熱された空気と熱交換して冷却し、低温再生熱交換器にて高温再生熱交換器で冷却された作動ガスを外気と熱交換してさらに冷却し、高温再生熱交換器からの予熱混合ガスを燃焼器及びガス化炉に導入するようにした請求項１記載の常圧ガス化発電装置

【請求項３】　タービンと圧縮機で構成されているターボ機械のタービン前段に燃焼器を配し、その作動流体が燃焼器、タービン、圧縮機の順序で通過することで軸出力を生じさせて発電を行うタービン発電装置において、タービンを出た高温作動ガスの冷却を圧縮機の吸引力を利用して取り入れた外気及び圧縮機からの排気ガスの一部との熱交換で行う直列に配した２つの再生熱交換器と、圧縮機の入口及び中間で作動ガスを冷却媒体と熱交換して冷却する冷却器とを備え、直列に設けた再生熱交換器が、タービンを出た高温作動ガスを高温再生熱交換器、低温再生熱交換器の順で通過させて冷却し、高温再生熱交換器にてタービン出口の高温作動ガスを圧縮機からの排気ガスの一部及び低温再生熱交換器で排気ガスと同温度レベルに予熱された空気と熱交換して冷却し、低温再生熱交換器にて高温再生熱交換器で冷却された作動ガスを外気と熱交換してさらに冷却し、高温再生熱交換器からの予熱混合ガスを燃焼器に導入するようにしたことを特徴とする排気循環型常圧発電装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、常圧燃焼で得られた常圧の高温ガスをタービンにて膨張させ、再生熱交換器、冷却器による熱回収後、圧縮機により吸引・昇圧し、排気する構成のガスタービンによる発電装置に関するものである。

【０００２】

【従来の技術】従来、ガスタービンのようなタービンを

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有するエンジンでは、まず大気圧の空気を圧縮機にて昇圧して燃焼器に導き、燃料と混合して燃焼させ、その後タービンで動力を回収していたため、燃料を圧縮機出口空気圧力よりも必ず高くする必要があり、常圧燃焼、常圧排熱利用ができないことから、各種ガス化燃料・固形燃料・未利用高温ガスを利用することは困難である。また、ガスエンジンのように排気ガスを循環させて系外への放出熱量を削減することは構造上無理であり、サイクル上デメリットとなる。

【０００３】また、分散型発電システムとして、バイオマスや廃棄物等をガス化炉でガス化燃焼させ、ガス化炉生成ガスを利用してガスタービン又はガスエンジンで発電を行うシステムの開発が進められているが、ガスエンジンでは、ガス化炉にて高温で生成したガスの冷却が必要であり、ガス中に含まれるタール分が凝縮することから、生成ガスカロリーの減少による発電効率低下、ラインの閉塞等のトラブル発生、タール分を含む廃水の処理などの問題がある。また、従来のガスタービンでは、上述したように燃料を加圧する必要があり、燃料圧縮機の手前でガス化炉生成ガスを冷却するので、発電効率の低下、タールによる閉塞トラブル等、タールを含む廃水の処理などの問題がある。この場合、ガス化炉を加圧ガス化炉とすれば、高温ガスがそのまま投入可能となるため、ガス冷却に起因するタールの問題は無くなるが、加圧ガス化炉では燃料供給系統、灰処理系統にロックホッパあるいは同等のハンドリング設備が必要で、固体ハンドリング、コスト、運用の面から適用には問題がある。

【０００４】

【発明が解決しようとする課題】上述したような従来の常圧ガス化ガスエンジン発電システム、常圧ガス化ガスタービン発電システム、加圧ガス化ガスタービン発電システムの種々の問題点は、常圧・高温ガスを投入できる内燃機関があれば解決することができる。また、常圧・高温ガスを使用するシステムであれば、従来のガスタービンでは不可能であった排気ガスの循環が可能となり、効率を高めることができる。

【０００５】本発明は上記の諸点に鑑みなされたもので、本発明の目的は、常圧から高温のガスをタービンで膨張させ、ガスを冷却（熱回収）の後、後段の圧縮機に導くことにより軸出力を生じるサイクルを採用することで、常圧・高温ガスからのエネルギ回収が可能な従来とは全く異なるガスタービンを開発して、常圧ガス化発電システムに適用することにある。また、本発明の目的は、常圧・高温ガスをタービン内に吸引し、後段の圧縮機との間の再生器により熱回収を行うシステムにおいて、空気とともに圧縮機から出た排気ガスの一部を再生器に導入して、再生器で効率よく予熱された混合ガスを燃焼空気として用いることにある。

【０００６】なお、常圧燃焼で得られた常圧の高温ガスをタービンにて膨張させ、再生熱交換器、冷却器による

熱回収後、圧縮機により吸引・昇圧し、排気する構成の常圧燃焼タービンは既に特許出願されている（特願２００１－９１４０５）。

【０００７】

【課題を解決するための手段】上記の目的を達成するために、本発明の常圧ガス化発電装置は、タービンと圧縮機で構成されているターボ機械のタービン前段に燃焼器を配し、その作動流体が燃焼器、タービン、圧縮機の順序で通過することで軸出力を生じさせて発電を行うタービン発電装置において、各種燃料、バイオマス又は／及び廃棄物をガス化燃焼させるガス化炉と、タービンを出た高温作動ガスを外気と熱交換して冷却するとともに外気を予熱する再生熱交換器と、圧縮機の入口及び中間で作動ガスを冷却媒体と熱交換して冷却する冷却器とを備え、ガス化炉で生成した可燃ガスを燃料として燃焼器に導入するとともに、再生熱交換器からの予熱空気を燃焼器及びガス化炉に導入するように構成されている（図１参照）。

【０００８】上記の装置においては、再生熱交換器を直列に２つ設けて、タービンを出た高温作動ガスを高温再生熱交換器、低温再生熱交換器の順で通過させて冷却し、高温再生熱交換器にてタービン出口の高温作動ガスを圧縮機からの排気ガスの一部及び低温再生熱交換器で排気ガスと同温度レベルに予熱された空気と熱交換して冷却し、低温再生熱交換器にて高温再生熱交換器で冷却された作動ガスを外気と熱交換してさらに冷却し、高温再生熱交換器からの予熱混合ガスを燃焼器及びガス化炉に導入する構成としてもよい（図３参照）。

【０００９】本発明の排気循環型常圧発電装置は、タービンと圧縮機で構成されているターボ機械のタービン前段に燃焼器を配し、その作動流体が燃焼器、タービン、圧縮機の順序で通過することで軸出力を生じさせて発電を行うタービン発電装置において、タービンを出た高温作動ガスの冷却を圧縮機の吸引力を利用して取り入れた外気及び圧縮機からの排気ガスの一部との熱交換で行う直列に配した２つの再生熱交換器と、圧縮機の入口及び中間で作動ガスを冷却媒体と熱交換して冷却する冷却器とを備え、直列に設けた再生熱交換器が、タービンを出た高温作動ガスを高温再生熱交換器、低温再生熱交換器の順で通過させて冷却し、高温再生熱交換器にてタービン出口の高温作動ガスを圧縮機からの排気ガスの一部及び低温再生熱交換器で排気ガスと同温度レベルに予熱された空気と熱交換して冷却し、低温再生熱交換器にて高温再生熱交換器で冷却された作動ガスを外気と熱交換してさらに冷却し、高温再生熱交換器からの予熱混合ガスを燃焼器に導入するようにしたことを特徴としている（図２参照）。

【００１０】

【発明の実施の形態】以下、本発明の実施の形態について説明するが、本発明は下記の実施の形態に何ら限定されるものではなく、適宜変更して実施することが可能なものである。図１は、本発明の実施の第１形態による常圧ガス化発電装置を示している。図１に示すように、各種固形燃料（一例として、バイオマス、廃棄物など）をガス化炉１０でガス化燃焼させ、生成したガス化ガスを燃料として常圧で燃焼器１２に導入する。燃焼器１２内の圧力は大気圧以下であり、後述する外気吸入の再生熱交換器１４で予熱された新鮮な空気は大気圧より多少低い圧力で燃焼器１２に流入する。常圧・高温のガス化炉生成ガスをそのまま燃焼器１２に投入でき、生成ガスを昇圧したり冷却する必要はない。なお、ガス中のタール分は、燃焼器１２での燃焼過程で分解・燃焼し、二酸化炭素と水になる。

【００１１】燃焼器１２で得られた常圧・高温の燃焼ガスをタービン１６にて膨張させ、発生した動力で発電機１８を駆動し発電を行う。タービン１６を出た高温の排気ガスは、まず再生熱交換器１４で外気と熱交換して冷却される。再生熱交換器１４で予熱された高温空気は、前述したように燃焼器１２に導入するだけでなく、ガス化炉１０にも導入することができる。このように、再生熱交換器１４で回収したタービン排熱を、燃焼器１２での燃焼過程及びガス化炉１０でのガス化反応に有効利用することができる。

【００１２】空気と熱交換して冷却された排気ガスは、さらに圧縮機入口と中間で水などの流体と熱交換して効率よく冷却される。図１においては、低圧圧縮機２０の入口で低圧冷却器２２によって排気ガスの温度を下げるとともにガス中の水分を凝縮させ、低圧圧縮機２０と高圧圧縮機２４の中間で高圧冷却器２６によって排気ガスの温度を下げるとともにガス中の水分を凝縮させて、圧縮機に導く排気ガス量を少なくし、圧縮動力を削減する。なお、冷却器で熱交換に用いる流体としては、水の他に、海水、海洋深層水、ＬＮＧ等を用いることができ、水からは温水、ＬＮＧからは天然ガスが得られる。また、低温の海洋深層水を冷却に有効利用してもよい。冷却効率は劣るが、冷却器の冷却流体として空気等を用いることも可能である。圧縮機（低圧圧縮機２０、高圧圧縮機２４）で昇圧された排気ガスは、煙突２８から系外に排出される。

【００１３】図２は、本発明の実施の第２形態による排気循環型常圧発電装置を示している。図２に示すように、燃焼器１２には燃料を常圧で導入する。燃焼器１２内の圧力は大気圧以下であり、後述する空気と排気ガスの混合ガスは大気圧より多少低い圧力で燃焼器１２に流入する。燃焼器１２に大気圧状態の燃料を昇圧することなく投入できるので、燃料圧縮機は不要である。燃焼器１２で得られた常圧・高温の燃焼ガスをタービン１６にて膨張させ、発生した動力で発電機１８を駆動し発電を行う。

【００１４】タービン１６を出た高温の排気ガスは、高

温再生熱交換器３０、低温再生熱交換器３２を通過して冷却される。上述したように燃焼器内圧力が大気圧以下のため、圧縮機から出た排気ガスを循環させ燃焼空気として用いることが可能となり、再生熱交換器に排気ガスの一部を導入する構成としたものである。排気ガスを循環させ燃焼空気として用いることで、系外への放出熱量を削減して効率を高めることができる。この場合、例えば、再生熱交換器を直列に２つ設けて、図２に示すように、高温再生熱交換器３０にてタービン出口の高温作動ガスを圧縮機からの排気ガスの一部及び低温再生熱交換器３２で排気ガスと同温度レベルに予熱された空気と熱交換して冷却し、低温再生熱交換器３２にて高温再生熱交換器３０で冷却された作動ガスを外気と熱交換してさらに冷却し、高温再生熱交換器３０からの予熱混合ガスを燃焼器１２に導入する構成とする。このように、低温再生と高温再生など、２つ以上の再生熱交換器が直列に並んでおり、排気循環システムなど２種類以上の昇温するガス（例えば、空気と循環排気ガス）がある場合、入口温度レベル（例えば、空気なら１５℃、循環排気ガスなら９０℃）によって投入する場所を変えて、温度の差異による混合の損失を極力抑えることが可能である。また、各熱交換器の温度レベルによって最適な材質を使用することが可能であり、高性能、省コスト、省スペースの実現が可能である。

【００１５】空気及び循環排気ガスと熱交換して冷却された排気ガスは、さらに圧縮機入口と中間で水などの流体と熱交換して効率よく冷却される。圧縮機で昇圧された排気ガスが系外に排出される。これらの詳細は、実施の第１形態の場合と同様である。

【００１６】図３は、本発明の実施の第３形態による常圧ガス化発電装置を示している。本実施の形態は、実施の第１形態における常圧ガス化発電装置の構成に、実施の第２形態の排気循環システム用の再生熱交換器を適用したものである。その構成及び作用等は、実施の第１形態及び第２形態と同様である。

【００１７】

【発明の効果】本発明は上記のように構成されているので、つぎのような効果を奏する。

（１）　常圧燃焼、常圧排熱利用が可能であり、燃料を昇圧する必要がないため、ガス化炉生成ガスをそのまま発電システムで使用することができる。また、加圧ガス化炉としなくて良いので、低コストで運用も容易である。

（２）　再生熱交換器で回収したタービン排熱は、燃焼器での燃焼過程及びガス化炉でのガス化反応に有効利用することができ、燃料量を削減できる。

（３）　圧縮機から出た排気ガスを循環させ燃焼空気として用いることで、系外への放出熱量を削減し、効率を高めることができる。

（４）　低温再生と高温再生など、２つ以上の再生熱交換器を直列に設けることにより、排気循環システムなど２種類以上の昇温するガス（例えば、空気と循環排気ガス）がある場合に、入口温度レベル（例えば、空気なら１５℃、循環排気ガスなら９０℃）によって投入する場所を変えて、温度の差異による混合の損失を極力抑えることが可能である。また、各熱交換器の温度レベルによって最適な材質を使用することが可能であり、高性能、省コスト、省スペースの実現が可能である。

【図面の簡単な説明】

【図１】本発明の実施の第１形態による常圧ガス化発電装置を示す概略構成説明図である。

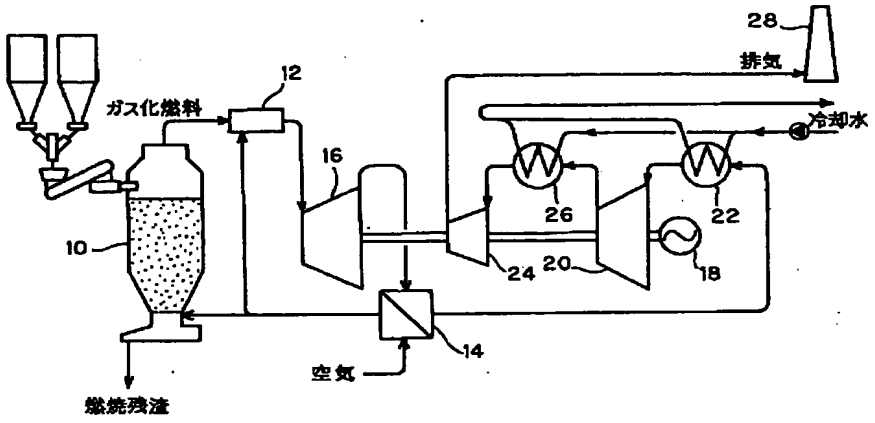
【図２】本発明の実施の第２形態による排気循環型常圧発電装置を示す概略構成説明図である。

【図３】本発明の実施の第３形態による常圧ガス化発電装置を示す概略構成説明図である。

【符号の説明】

１０　ガス化炉
１２　燃焼器
１４　再生熱交換器
１６　タービン
１８　発電機
２０　低圧圧縮機
２２　低圧冷却器
２４　高圧圧縮機
２６　高圧冷却器
２８　煙突
３０　高温再生熱交換器
３２　低温再生熱交換器

【図１】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排気
12
ガス化燃料
冷却水
16
10
26
22
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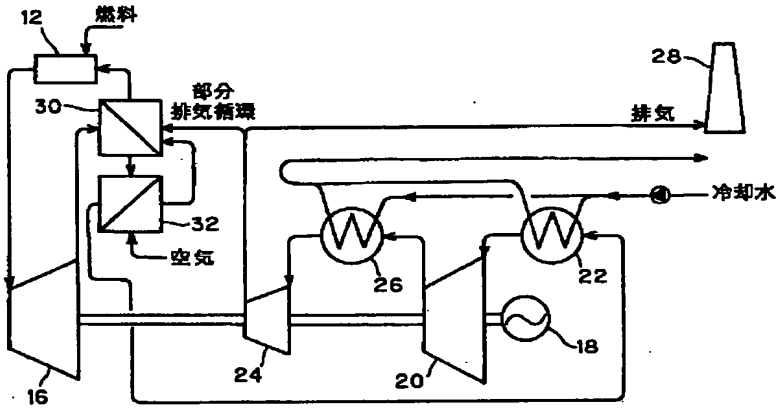
20
18
14
空気
燃焼残渣

【図２】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燃料
28
部分
排気循環
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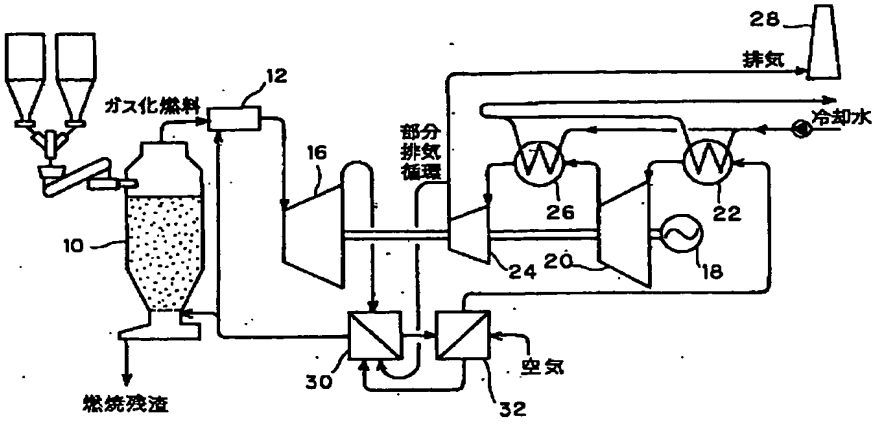
排気
冷却水
32
空気
26
22
18
24
20
16

【図３】


28
排気
12
ガス化燃料
冷却水
部分
排気
循環
16
10
26
22
24
20
18
30
空気
32
燃焼残渣

フロントページの続き

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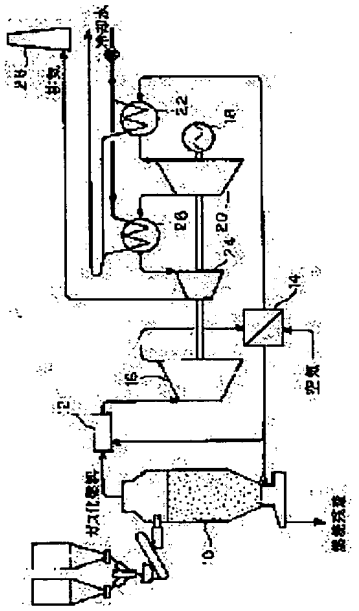
(54) ATMOSPHERIC PRESSURE GASIFICATION GENERATING DEVICE AND EMISSION CIRCULATION TYPE ATMOSPHERIC PRESSURE GENERATING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To develop a technique suitable for recovering energy from atmospheric pressure and high temperature gas.
SOLUTION: In a turbine generating device, a combustor 12 is arranged at a front stage of a turbine 16 of a turbo machine, wherein the turbine 16 and compressors 20, 24 are connected with a shaft. Working fluid sequentially passes through the combustor 12, the turbine 16, and the compressors 20, 24 so as to generate axial output for generating power. This device comprises a gasification furnace 10 for gasification combusting various fuels, biomass and/or wastes; a regeneration heat exchanger 14 for heat-exchanging and cooling high temperature working gas from the turbine 16 with outside air, and preheating the outside air; and coolers 22, 26 for heat-exchanging the working gas with cooling medium at the inlet and intermediate of the compressors 20, 24 and cooling the gas. Combustible gas generated in the gasification furnace 10 is introduced to the combustor 12 as fuel, and the preheated air from the regeneration heat exchanger 14 is introduced to the combustor 12 and the gasification furnace 10.



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[Date of final disposal for application]

[Patent number]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] In the turbine power plant which arranges a combustor on a turbine and the turbine preceding paragraph of the turbomachinery which consists of compressors, and generates electricity by the working fluid producing a brake horsepower by passing in order of a combustor, a turbine, and a compressor The gasifier which carries out gasification combustion of various fuels, biomass, or/and the trash, The regenerated heat exchanger which heats the open air beforehand while carrying out heat exchange of the elevated-temperature working medium which came out of the turbine to the open air and cooling, While having the condensator which carries out heat exchange of the working medium to a cooling medium, and is cooled in the inlet port of a compressor, and middle and introducing into a combustor by using as a fuel the combustible gas generated by the gasifier Ordinary pressure gasification-power-generation equipment characterized by introducing the tempered air from a regenerated heat exchanger into a combustor and a gasifier.
[Claim 2] The elevated-temperature working medium which prepared the regenerated heat exchanger in two serials, and came out of the turbine An elevated-temperature regenerated heat exchanger, Make it pass in order of a low-temperature regenerated heat exchanger, and cool, and in an elevated-temperature regenerated heat exchanger, carry out heat exchange of the elevated-temperature working medium of a turbine outlet to the air by which the preheating was carried out to exhaust gas and this temperature level at the part and low-temperature regenerated heat exchanger of exhaust gas from a compressor, and it cools. Ordinary pressure gasification-power-generation equipment according to claim 1 which heat-exchange-cools further by making into the open air working medium cooled by the elevated-temperature regenerated heat exchanger in the low-temperature regenerated heat exchanger, and introduced the preheating mixed gas from an elevated-temperature regenerated heat exchanger into the combustor and the gasifier [claim 3] In the turbine power plant which arranges a combustor on a turbine and the turbine preceding paragraph of the turbomachinery which consists of compressors, and generates electricity by the working fluid producing a brake horsepower by passing in order of a combustor, a turbine, and a compressor Two regenerated heat exchangers allotted to the serial performed by the open air which took in cooling of the elevated-temperature working medium which came out of the turbine using the suction force of a compressor, and the heat exchange of a part of exhaust gas from a compressor, It has the condensator which carries out heat exchange of the working medium to a cooling medium, and is cooled in the inlet port of a compressor, and middle. The regenerated heat exchanger prepared in the serial the elevated-temperature working medium which came out of the turbine An elevated-temperature regenerated heat exchanger, Make it pass in order of a low-temperature regenerated heat exchanger, and cool, and in an elevated-temperature regenerated heat exchanger, carry out heat exchange of the elevated-temperature working medium of a turbine outlet to the air by which the preheating was carried out to exhaust gas and this temperature level at the part and low-temperature regenerated heat exchanger of exhaust gas from a compressor, and it cools. The exhaust air cycloid type ordinary pressure power plant which carries out heat exchange of cooling further and having introduced the preheating mixed gas from an elevated-temperature regenerated heat exchanger into the combustor to the description by making into the open air working medium cooled by the elevated-temperature regenerated heat exchanger in the low-temperature regenerated heat exchanger.

[Translation done.]

* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention expands in a turbine the elevated-temperature gas of the ordinary pressure obtained by ordinary pressure combustion, and suction and the pressure up of it are carried out with a compressor after the heat recovery by the regenerated heat exchanger and the condensator, and it relates to the power plant by the gas turbine of a configuration of exhausting.
[0002]
[Description of the Prior Art] since the pressure up of the air of atmospheric pressure be first carry out with a compressor with the engine which have a turbine like a gas turbine , and it lead to a combustor , it be necessary conventionally to make a fuel surely higher than compressor outlet air pressure since mix with a fuel , it be made to burn and the turbine be recover power after that , and ordinary pressure combustion and ordinary pressure exhaust heat use cannot be perform , it be difficult to use various gasification fuel , solid fuel , and unused elevated temperature gas . Moreover, it is unreasonableness on structure to circulate exhaust gas like a gas engine and to reduce the emission heating value to the outside of a system, and it serves as a cycle top demerit.
[0003] Moreover, although development of the system which is made to carry out gasification combustion of biomass, the trash, etc. by the gasifier, and generates electricity with a gas turbine or a gas engine as a distributed generation-of-electrical-energy system using gasifier generation gas is furthered In a gas engine, the gas generated at the elevated temperature needs to be cooled of a gasifier, and since the tar contained in gas condenses, there are problems, such as trouble generating of the generating efficiency fall by reduction of a generation gas calorie, lock out of Rhine, etc. and processing of the waste water containing a tar. Moreover, in the conventional gas turbine, since it is necessary to pressurize a fuel as mentioned above, and gasifier generation gas is cooled before a fuel compressor, the lock out trouble by decline in generating efficiency and tar etc. has problems, such as processing of the waste water containing tar. In this case, although the problem of the tar resulting from gas cooling is lost since the injection of a pressurized gasification furnace, then elevated-temperature gas is attained as it is in a gasifier, at a pressurized gasification furnace, a lock hopper or an equivalent handling facility is required for a fuel feed system and an ashes processing network, and there is a problem in application from solid-state handling, cost, and the field of employment.
[0004]
[Problem(s) to be Solved by the Invention] The various troubles of the conventional ordinary pressure gasification gas-engine-driven-power-generation system which was mentioned above, an ordinary pressure gasification gas-turbine-power-generation system, and a pressurized gasification gas-turbine-power-generation system are solvable if there is an internal combustion engine which can supply ordinary pressure and elevated-temperature gas. Moreover, if it is the system which uses ordinary pressure and elevated-temperature gas, in the conventional gas turbine, circulation of the impossible exhaust gas is attained and effectiveness can be raised.
[0005] It is in this invention having been made in view of above-mentioned many points, and the purpose of this invention being adopting the cycle which produces a brake horsepower by expanding the gas of an elevated temperature [ordinary pressure] in a turbine, and leading it to a latter compressor after cooling gas (heat recovery), developing a completely different gas turbine from the former in which the energy recovery from ordinary pressure and elevated-temperature gas is possible, and applying to an ordinary pressure gasification-power-generation system. Moreover, the purpose of this invention is to attract ordinary pressure and elevated-temperature gas in a turbine, introduce into a regenerator a part of exhaust

gas which came out of the compressor with air in the system which performs heat recovery with the regenerator between latter compressors, and use the mixed gas by which the preheating was efficiently carried out with the regenerator as a combustion air.
[0006] In addition, the elevated-temperature gas of the ordinary pressure obtained by ordinary pressure combustion is expanded in a turbine, suction and a pressure up are carried out with a compressor after the heat recovery by the regenerated heat exchanger and the condensator, and patent application of the ordinary pressure combustion turbine of a configuration of exhausting has already been carried out (application for patent 2001-91405).
[0007]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the ordinary pressure gasification-power-generation equipment of this invention In the turbine power plant which arranges a combustor on a turbine and the turbine preceding paragraph of the turbomachinery which consists of compressors, and generates electricity by the working fluid producing a brake horsepower by passing in order of a combustor, a turbine, and a compressor The gasifier which carries out gasification combustion of various fuels, biomass, or/and the trash, The regenerated heat exchanger which heats the open air beforehand while carrying out heat exchange of the elevated-temperature working medium which came out of the turbine to the open air and cooling, It has the condensator which carries out heat exchange of the working medium to a cooling medium, and is cooled in the inlet port of a compressor, and middle, and while introducing into a combustor by using as a fuel the combustible gas generated by the gasifier, it is constituted so that the tempered air from a regenerated heat exchanger may be introduced into a combustor and a gasifier (refer to drawing 1).
[0008] The elevated-temperature working medium which prepared the regenerated heat exchanger in two serials, and came out of the turbine in above equipment An elevated-temperature regenerated heat exchanger, Make it pass in order of a low-temperature regenerated heat exchanger, and cool, and in an elevated-temperature regenerated heat exchanger, carry out heat exchange of the elevated-temperature working medium of a turbine outlet to the air by which the preheating was carried out to exhaust gas and this temperature level at the part and low-temperature regenerated heat exchanger of exhaust gas from a compressor, and it cools. It is good also as a configuration which heat-exchange-cools further by making into the open air working medium cooled by the elevated-temperature regenerated heat exchanger in the low-temperature regenerated heat exchanger, and introduces the preheating mixed gas from an elevated-temperature regenerated heat exchanger into a combustor and a gasifier (refer to drawing 3).
[0009] The exhaust air cycloid type ordinary pressure power plant of this invention arranges a combustor on a turbine and the turbine preceding paragraph of the turbomachinery which consists of compressors. In the turbine power plant with which the working fluid generates electricity by producing a brake horsepower by passing in order of a combustor, a turbine, and a compressor Two regenerated heat exchangers allotted to the serial performed by the open air which took in cooling of the elevated-temperature working medium which came out of the turbine using the suction force of a compressor, and the heat exchange of a part of exhaust gas from a compressor, It has the condensator which carries out heat exchange of the working medium to a cooling medium, and is cooled in the inlet port of a compressor, and middle. The regenerated heat exchanger prepared in the serial the elevated-temperature working medium which came out of the turbine An elevated-temperature regenerated heat exchanger, Make it pass in order of a low-temperature regenerated heat exchanger, and cool, and in an elevated-temperature regenerated heat exchanger, carry out heat exchange of the elevated-temperature working medium of a turbine outlet to the air by which the preheating was carried out to exhaust gas and this temperature level at the part and low-temperature regenerated heat exchanger of exhaust gas from a compressor, and it cools. By making into the open air working medium cooled by the elevated-temperature regenerated heat exchanger in the low-temperature regenerated heat exchanger, it cools further and heat exchange of having introduced the preheating mixed gas from an elevated-temperature regenerated heat exchanger into the combustor is carried out to the description (refer to drawing 2).
[0010]
[Embodiment of the Invention] It is possible for this invention not to be limited to the gestalt of the following operation at all, to change it suitably, and to carry out hereafter, although the gestalt of operation of this invention is explained. Drawing 1 shows the ordinary pressure gasification-power-generation equipment by the 1st gestalt of operation of this invention. As shown in drawing 1 , gasification combustion of the various solid fuels (biomass, trash, etc. as an example) is carried out by the gasifier 10, and it introduces into a combustor 12 by ordinary pressure by using the generated gasification gas as a fuel. The pressure in a combustor 12 is below atmospheric pressure, and the fresh air by which

the preheating was carried out by the regenerated heat exchanger 14 of open air inhalation mentioned later flows into a combustor 12 by the low pressure somewhat from atmospheric pressure. Ordinary pressure and hot gasifier generation gas can be supplied to a combustor 12 as it is, and it is not necessary to carry out the pressure up of the generation gas, or to cool. In addition, the tar in gas decomposes and burns in the combustion process in a combustor 12, and becomes a carbon dioxide and water.

[0011] The ordinary pressure and the hot combustion gas which were obtained with the combustor 12 are expanded in a turbine 16, and it generates electricity by driving a generator 18 under the generated power. First, by the regenerated heat exchanger 14, heat exchange of the hot exhaust gas which came out of the turbine 16 is carried out to the open air, and it is cooled. As mentioned above, it not only introduces into a combustor 12 the elevated-temperature air by which the preheating was carried out by the regenerated heat exchanger 14, but it can introduce it into a gasifier 10. Thus, the turbine exhaust heat collected by the regenerated heat exchanger 14 can be used effectively for the combustion process in a combustor 12, and the gasification reaction in a gasifier 10.

[0012] Further, heat exchange of the exhaust gas cooled by carrying out heat exchange to air is carried out to fluids, such as water, and it is cooled efficiently in a compressor inlet port and middle. In drawing 1 , while lowering the temperature of exhaust gas with the low voltage condensator 22 at the inlet port of a low pressure compressor 20, make the moisture in gas condense, while lowering the temperature of exhaust gas with the high-pressure condensator 26 in the middle of a low pressure compressor 20 and a high pressure compressor 24, the moisture in gas is made to condense, the amount of exhaust gas led to a compressor is lessened, and compression power is reduced. In addition, as a fluid used for heat exchange with a condensator, seawater, deep sea water, LNG, etc. can be used other than water, and natural gas is obtained from warm water and LNG from water. Moreover, low-temperature deep sea water may be used effectively for cooling. Although cooling effectiveness is inferior, it is also possible to use air etc. as a cooling fluid of a condensator. The exhaust gas by which the pressure up was carried out with the compressor (a low pressure compressor 20, high pressure compressor 24) is discharged out of a system from a chimney stack 28.

[0013] Drawing 2 shows the exhaust air cycloid type ordinary pressure power plant by the 2nd gestalt of operation of this invention. As shown in drawing 2 , a fuel is introduced into a combustor 12 by ordinary pressure. The pressure in a combustor 12 is below atmospheric pressure, and the air mentioned later and the mixed gas of exhaust gas flow into a combustor 12 by the low pressure somewhat from atmospheric pressure. Since it can supply without carrying out the pressure up of the fuel of an atmospheric pressure condition to a combustor 12, the fuel compressor is unnecessary. The ordinary pressure and the hot combustion gas which were obtained with the combustor 12 are expanded in a turbine 16, and it generates electricity by driving a generator 18 under the generated power.

[0014] The hot exhaust gas which came out of the turbine 16 passes the elevated-temperature regenerated heat exchanger 30 and the low-temperature regenerated heat exchanger 32, and is cooled. Since combustor internal pressure is below atmospheric pressure as mentioned above, it becomes possible to circulate the exhaust gas which came out of the compressor, and to use as a combustion air, and considers as the configuration which introduces a part of exhaust gas into a regenerated heat exchanger. By circulating exhaust gas and using as a combustion air, the emission heating value to the outside of a system can be reduced, and effectiveness can be raised. As a regenerated heat exchanger is prepared in two serials in this case and it is shown in drawing 2 By the elevated-temperature regenerated heat exchanger 30, carry out heat exchange of the elevated-temperature working medium of a turbine outlet to the air by which the preheating was carried out to exhaust gas and this temperature level by the part and the low-temperature regenerated heat exchanger 32 of exhaust gas from a compressor, and it cools. By making into the open air working medium cooled by the elevated-temperature regenerated heat exchanger 30 by the low-temperature regenerated heat exchanger 32, it cools further and heat exchange is carried out to the configuration which introduces the preheating mixed gas from the elevated-temperature regenerated heat exchanger 30 into a combustor 12. Thus, when two or more regenerated heat exchangers, such as low-temperature playback and elevated-temperature playback, are located in a line with the serial and there is two or more kinds of gas (for example, air and circulation exhaust gas) which carries out a temperature up, such as an exhaust air circulation system, it is possible to change the location supplied with inlet temperature level (for example, if it is air and is 15 degrees C and circulation exhaust gas 90 degrees C), and to suppress loss of mixing by the difference in temperature as much as possible. Moreover, it is possible to use the optimal quality of the material with the temperature level of each heat exchanger, and high performance, ** cost, and space-saving implementation are possible.

[0015] Further, heat exchange of the exhaust gas cooled by carrying out heat exchange to air and

circulation exhaust gas is carried out to fluids, such as water, and it is cooled efficiently in a compressor inlet port and middle. The exhaust gas by which the pressure up was carried out with the compressor is discharged out of a system. These details are the same as that of the case of the 1st gestalt of operation.
[0016] Drawing 3 shows the ordinary pressure gasification-power-generation equipment by the 3rd gestalt of operation of this invention. The gestalt of this operation applies the regenerated heat exchanger for the exhaust air circulation systems of the 2nd gestalt of operation to the configuration of the ordinary pressure gasification-power-generation equipment in the 1st gestalt of operation. The configuration, operation, etc. are the same as that of the 1st gestalt of operation, and the 2nd gestalt.
[0017]
[Effect of the Invention] Since this invention is constituted as mentioned above, the following effectiveness is done so.
(1) Ordinary pressure combustion and ordinary pressure exhaust heat use are possible, and since it is not necessary to carry out the pressure up of the fuel, gasifier generation gas can be used by the generation-of-electrical-energy system as it is. Moreover, since it is not necessary to consider as a pressurized gasification furnace, employment is also easy at low cost.
(2) The turbine exhaust heat collected by the regenerated heat exchanger can be used effectively for the combustion process in a combustor, and the gasification reaction in a gasifier, and can reduce fuel quantity.
(3) By circulating the exhaust gas which came out of the compressor, and using as a combustion air, the emission heating value to the outside of a system can be reduced, and effectiveness can be raised.
(4) When there is two or more kinds of gas (for example, air and circulation exhaust gas) which carries out a temperature up, such as an exhaust air circulation system, by preparing two or more regenerated heat exchangers, such as low-temperature playback and elevated-temperature playback, in a serial, it is possible to change the location supplied with inlet temperature level (for example, if it is air and is 15 degrees C and circulation exhaust gas 90 degrees C), and to suppress loss of mixing by the difference in temperature as much as possible. Moreover, it is possible to use the optimal quality of the material with the temperature level of each heat exchanger, and high performance, ** cost, and space-saving implementation are possible.

[Translation done.]

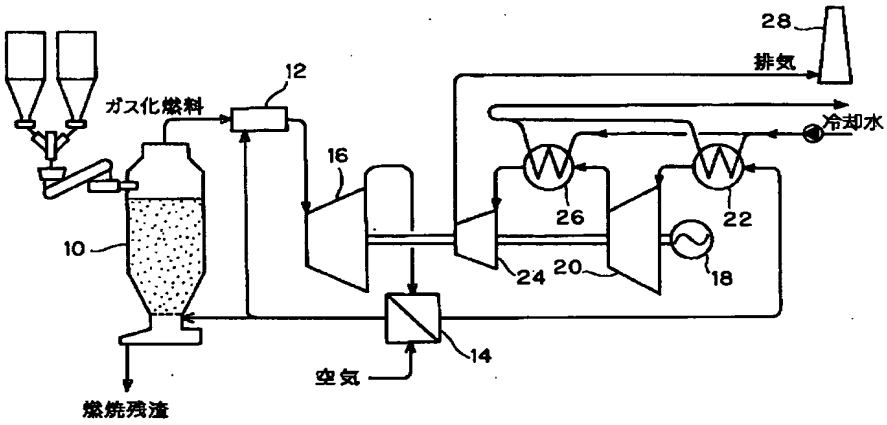
* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.

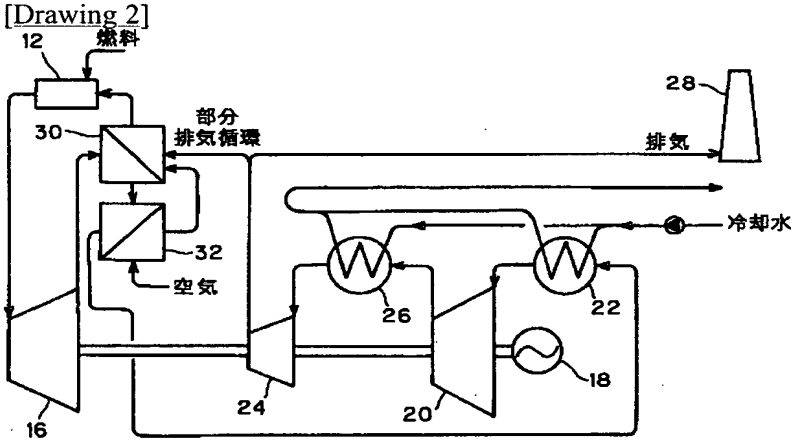
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

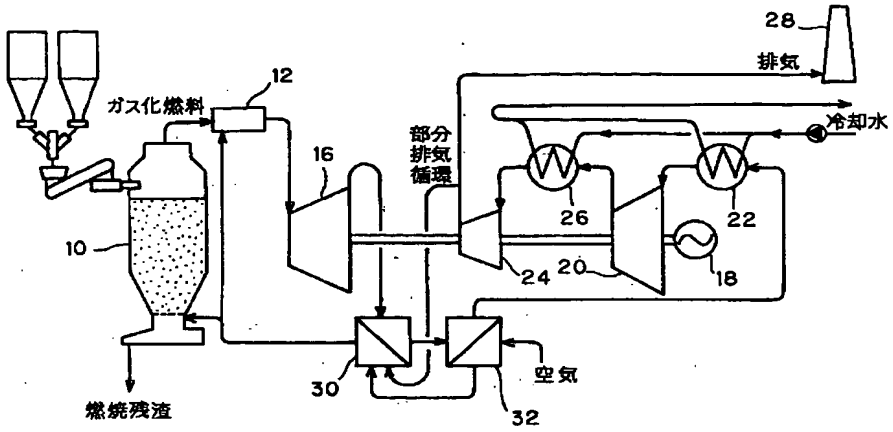
[Drawing 1]



[Drawing 2]



[Drawing 3]



[Translation done.]